FIG WORKING WEEK 2023
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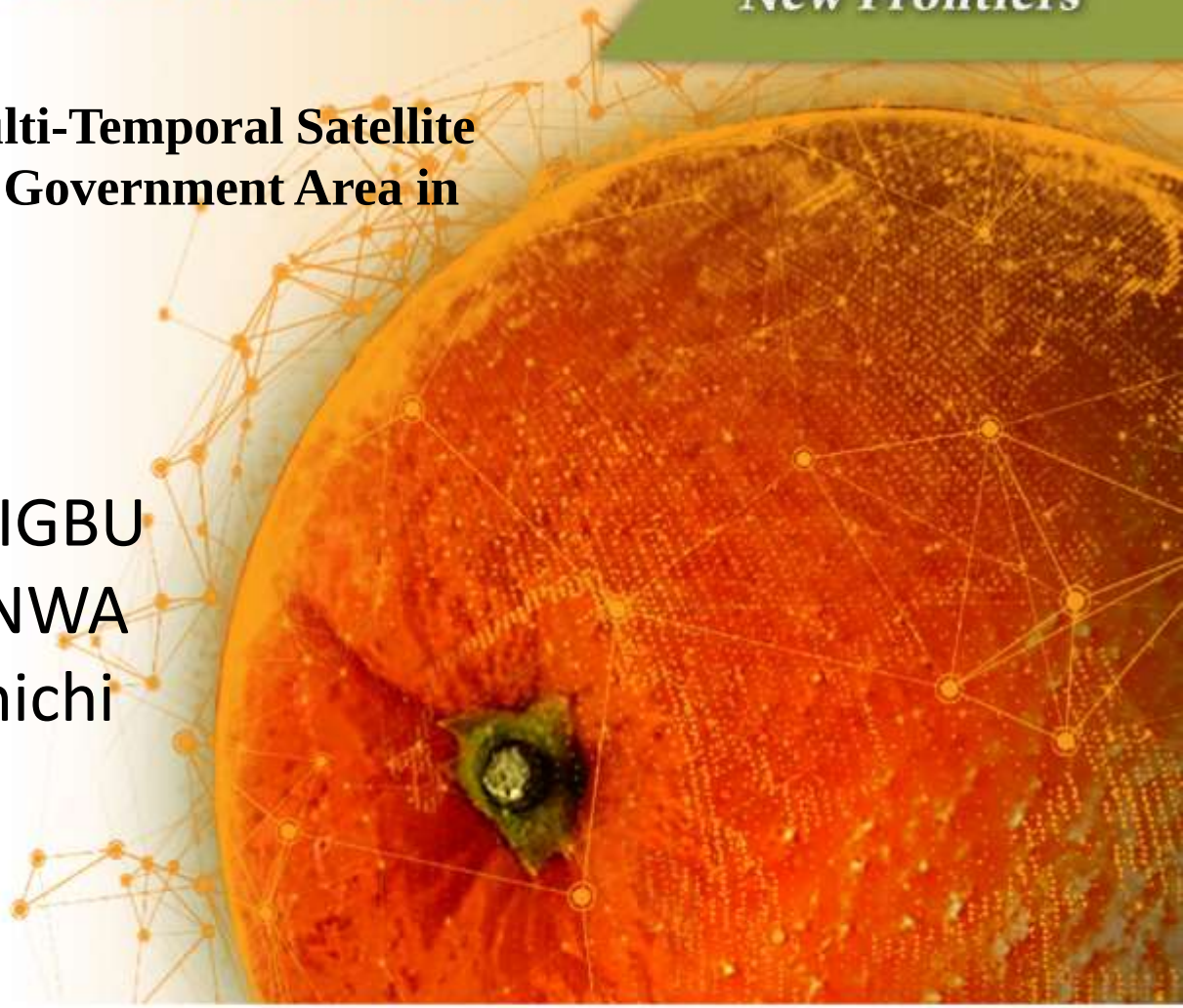
Protecting Our World, Conquering New Frontiers

Urban Land-Use Change Detection Using Multi-Temporal Satellite Imageries: A Case Study of Isuikwuato Local Government Area in



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INTRODUCTION[1]

The urban areas of any country are by no means static. It changes overtime. Globally, rapid population growth is intense in cities and is a major factor in land-use change (Onilude and Vaz, 2021). According to Oseni et al. (2020), every parcel of land on the Earth's surface is unique in the cover it possesses. Land use and land cover are distinct yet closely linked characteristics of the Earth's surface. The use to which man put land includes among others grazing, agriculture, urban development, logging, and mining among many others, whereas land cover categories comprise cropland, forest, wetland, pasture, roads, and urban areas, among others.

Land Use / Land Cover generally refers to the categorization or classification of human activities and natural elements on the landscape within a specific time frame based on established scientific and statistical methods of analysis of appropriate source materials. Land use/land cover changes are very dynamic and have to be monitored at regular intervals for sustainable environmental development. Comprehensive information on the spatial distribution of the land use/land cover categories and the pattern of their change is a prerequisite for planning, utilization, and management of the land resources of the country.

INTRODUCTION[2]

Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times (Olaleye et al. 2012). Olaleye et al.(2012) identified four aspects of land-use change detection that are important:

(i) Detecting the changes that have occurred (change/no-change),
(ii) Identifying the nature of the change,
(iii) Measuring the areal extent of the change and
(iv) Assessing the spatial pattern of the change.

Remote Sensing (RS) and Geographic Information System (GIS) have been recognized as powerful and effective tools and widely applied in detecting the Spatial-temporal dynamics of land use and land cover (Ujoh et al. 2011).The study was aimed at analyzing the urban land use and land cover changes in Isuikwuato Local Government Area over the last two decades using geospatial technologies. This aim was achieved through the following objectives:

Producing the land use land cover map of the study area for the years 2000, 2015, and 2022.

Carrying out change detection analysis vis-a-vis determination of the trend, nature, and rate of land use and land cover change of the study area.

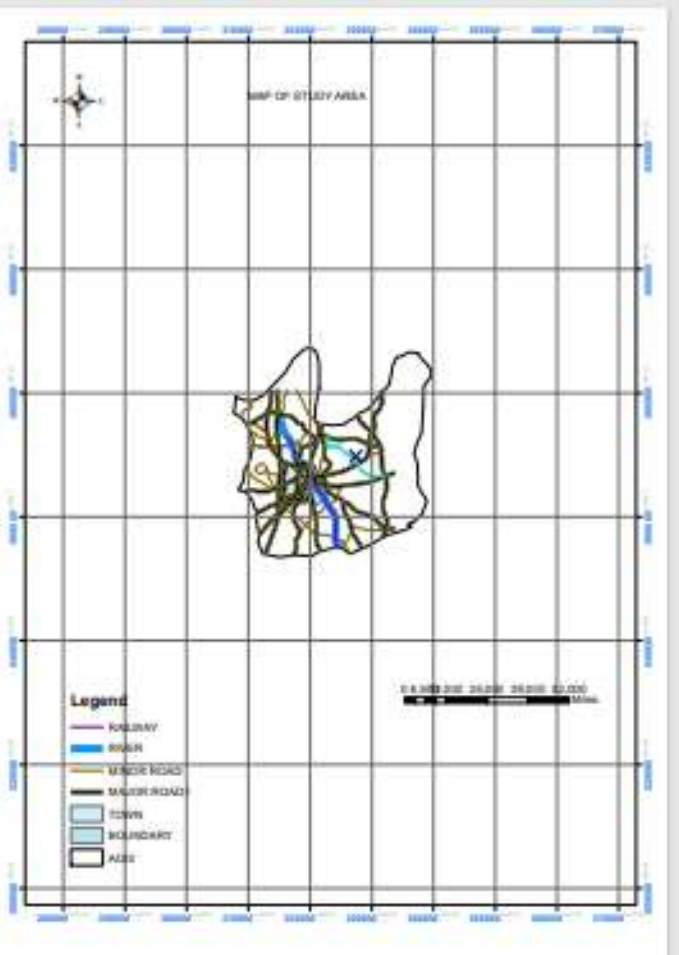
AIM AND OBJECTIVES

- This study, evaluate the effectiveness of topographic modelling (analysis) and the resultant land use management data in promoting sustainable development.
- The study investigates the place of topographic modelling, in identifying areas of high ecological value and also assessing the potential impacts of development projects on the environment, as well as the use of land use data in promoting compact, sustainable development patterns and minimizing the negative impacts of development on the environment.

DESCRIPTION OF THE STUDY AREA

The study area is old Aba, metropolis Abia state Nigeria, that comprises of Osisioma-Ngwa, Isiala-Ngwa North L.GA, Isiala-Ngwa South L.G.A, Obingwa L.G.A, Aba South L.G.A, Aba North L.G.A, Ukwa East L.G.A, Ukwa West L.G.A, and Ugwunabgo L.G.A with a total land mass of 1,116km^2.

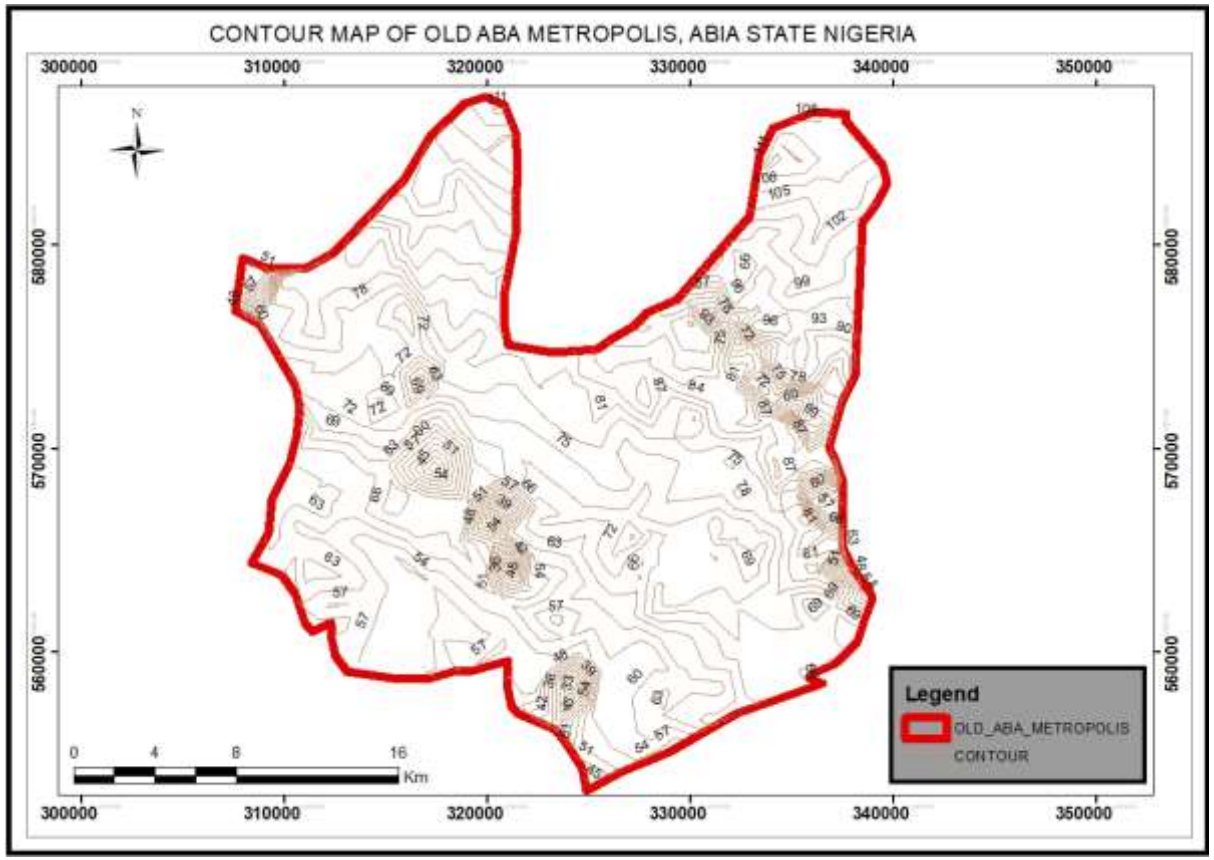
Aba is a low-lying coastal state in south-Eastern Nigeria located between longitudes 5°07’00N- 5°15’41''E and latitudes 7°22’00''N - 7°25’10’’N.



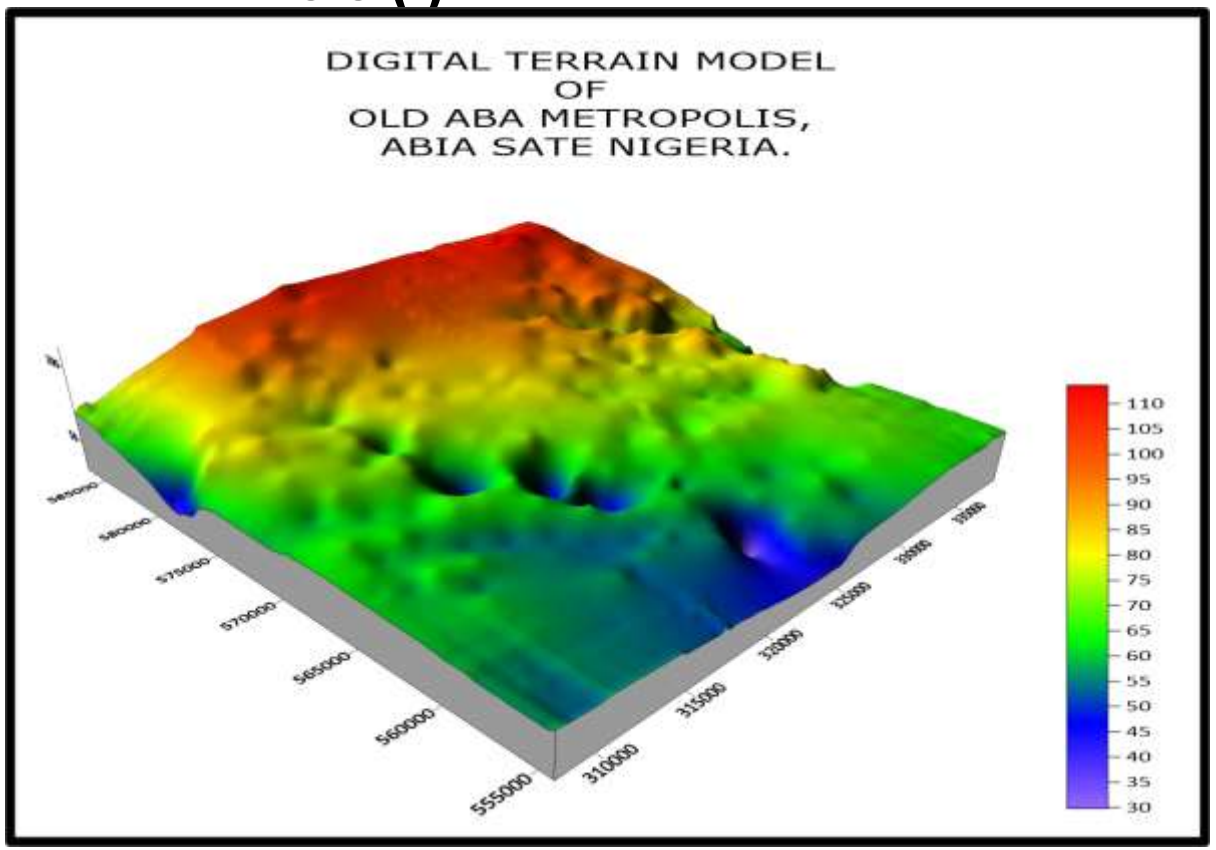
MATERIAL AND METHODS

- Sentinel 2 satellites image with 10m resolution,Google earth elevation dataset (2023),Tersus GNSS Rover data, ArcGIS 10.5 version, Surfer 11 software. Microsoft Excel, GPS Visualizer.
- To analyse the topographic configuration of the study area, the SRTM raster file was added to ARGIS 10.5 software progressively. The dataset was manipulated using spatial analysis tool. From the spatial analysis tool, contour lines, aspects, flow accumulations, slopes and digital terrain model were created. The Maximum Likelihood (MLH) method was adopted as the classification algorithm, and a total of 20 trained samples were used for each classification. The land use/ land cover themes were bare land, vegetation. Built-up areas and water bodies.

RESULTS AND ANALYSIS (I)

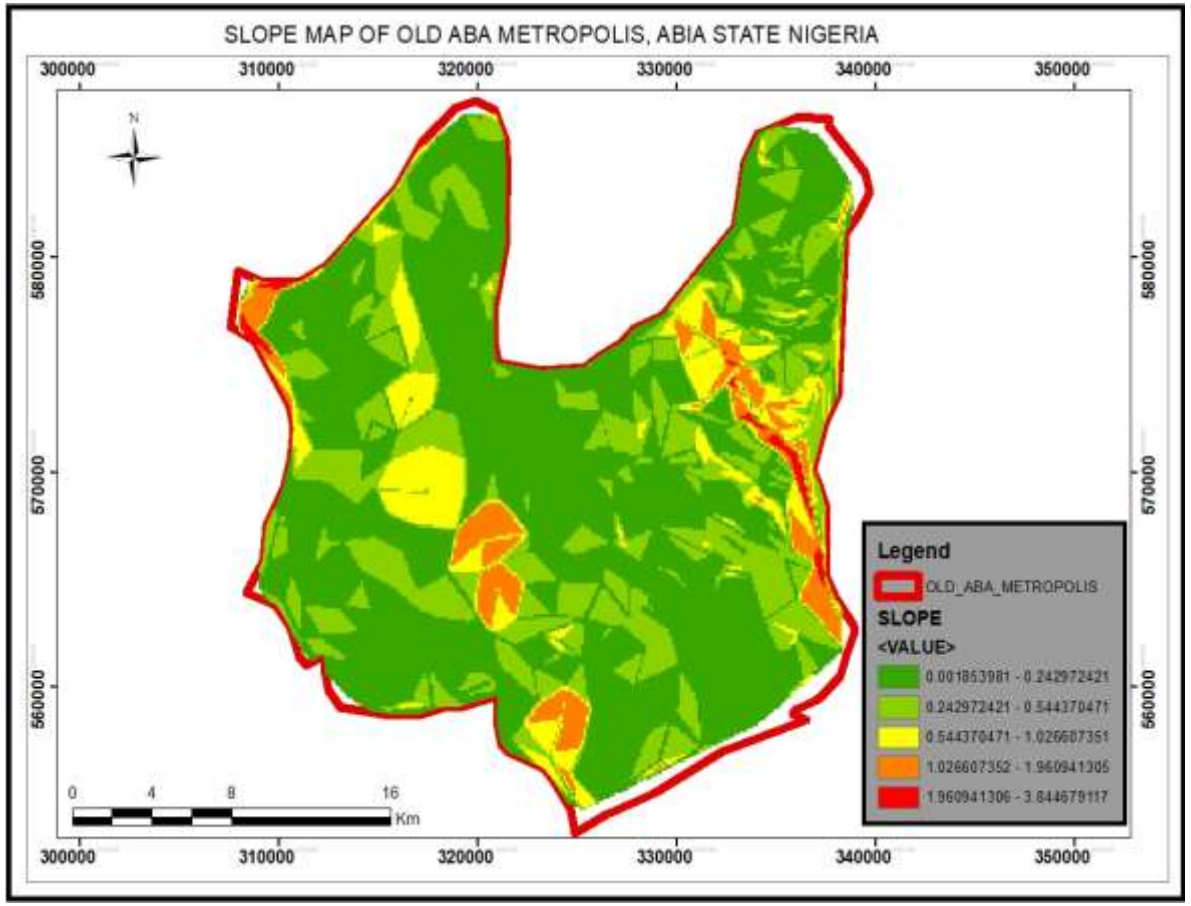


Contour map of the old Aba Metropolis. (Source. Okezie et al. 2023)

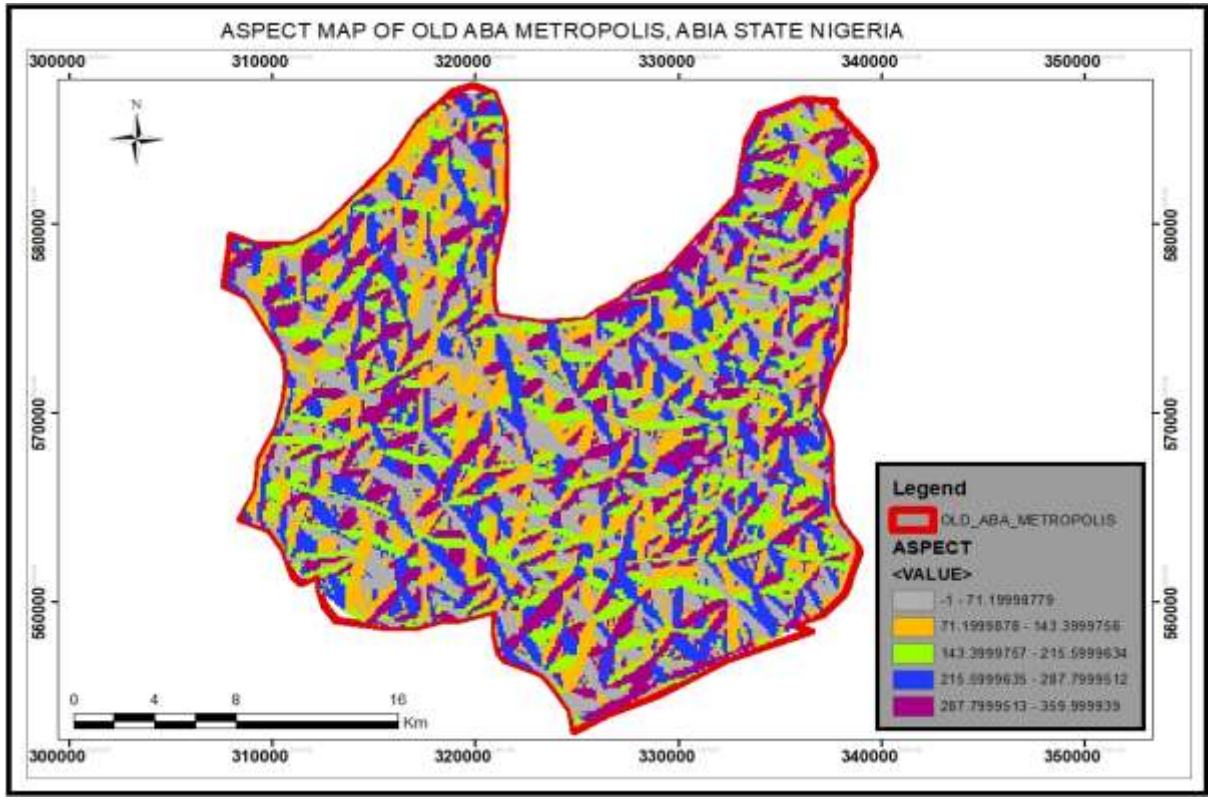


Digital terrain model of old Aba Metropolis. (Source. Okezie etal. 2023)

RESULTS AND ANALYSIS (I)

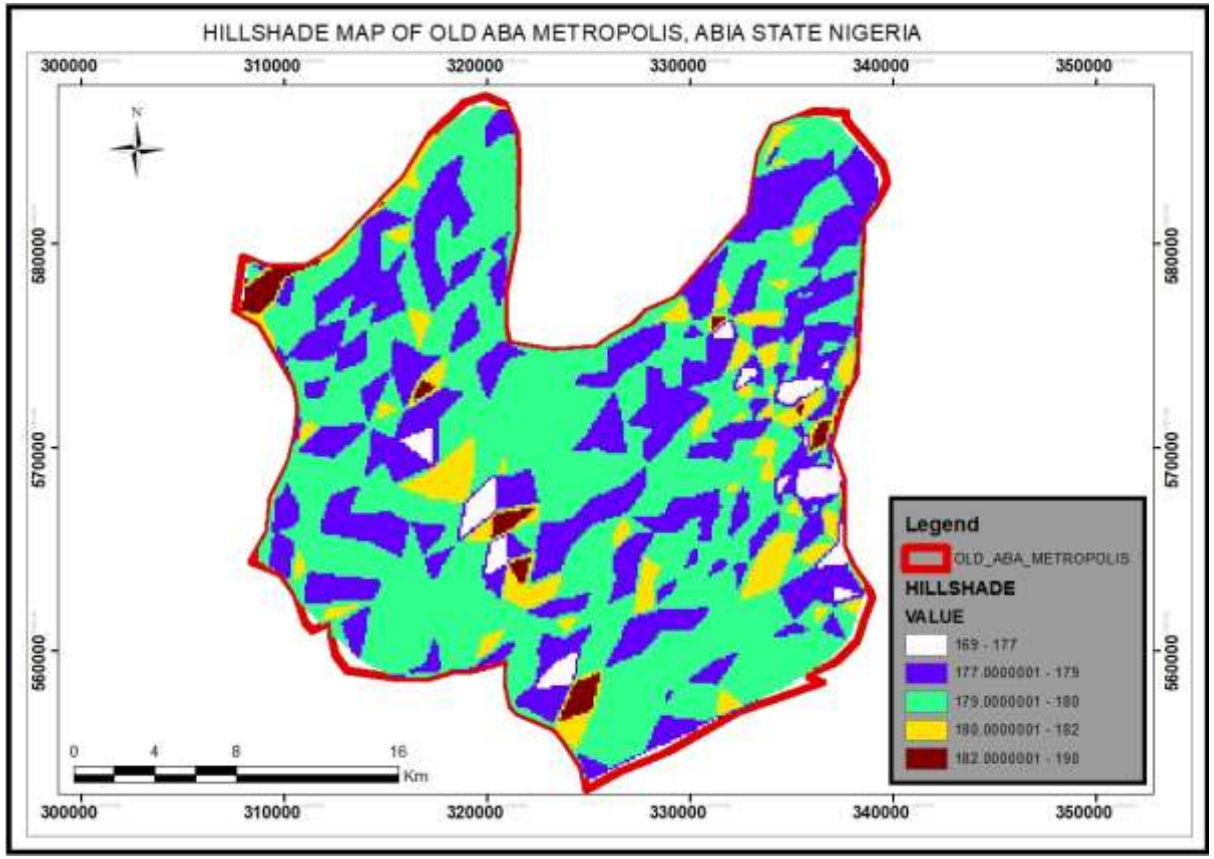


Slope map of old Aba Metropolis. (Source. Okezie etal. 2023)

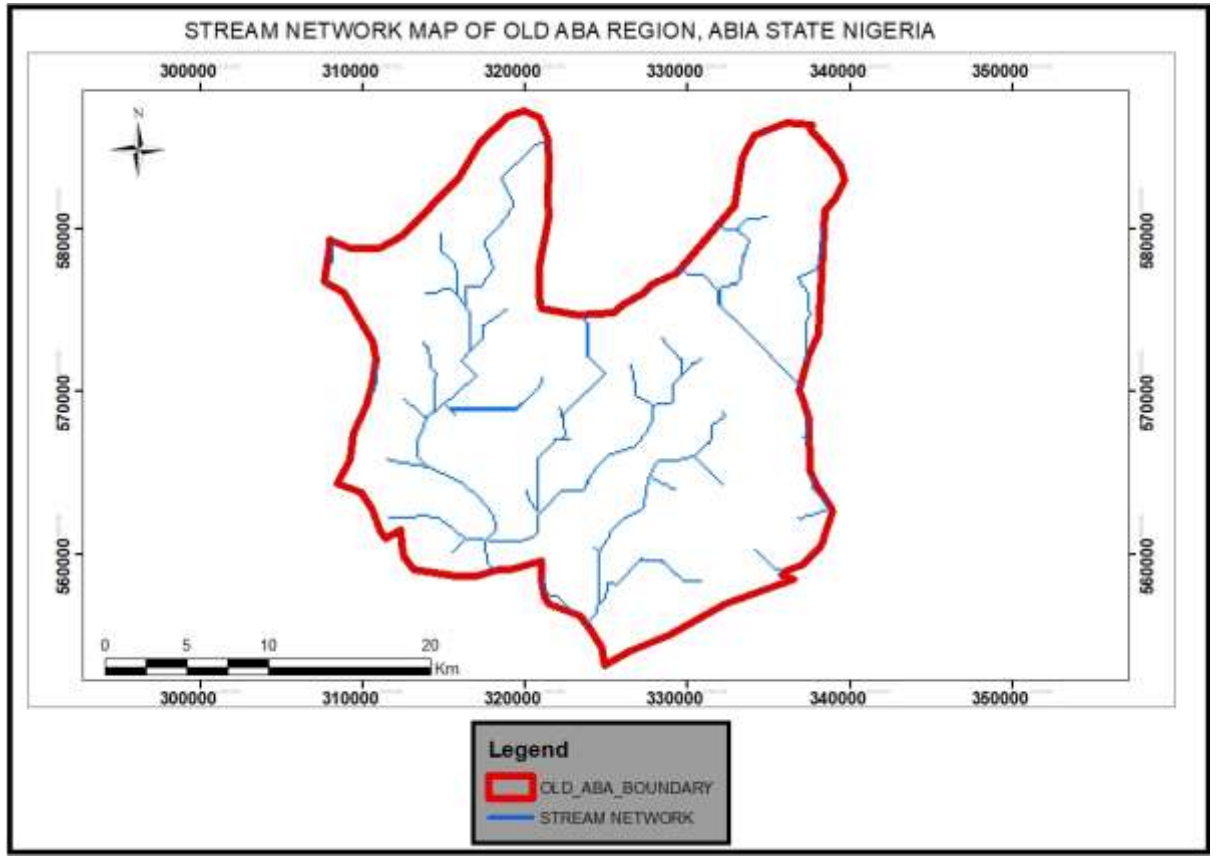


Aspect map of old Aba Metropolis. (Source. Okezie et al. 2023)

RESULTS AND ANALYSIS (I)

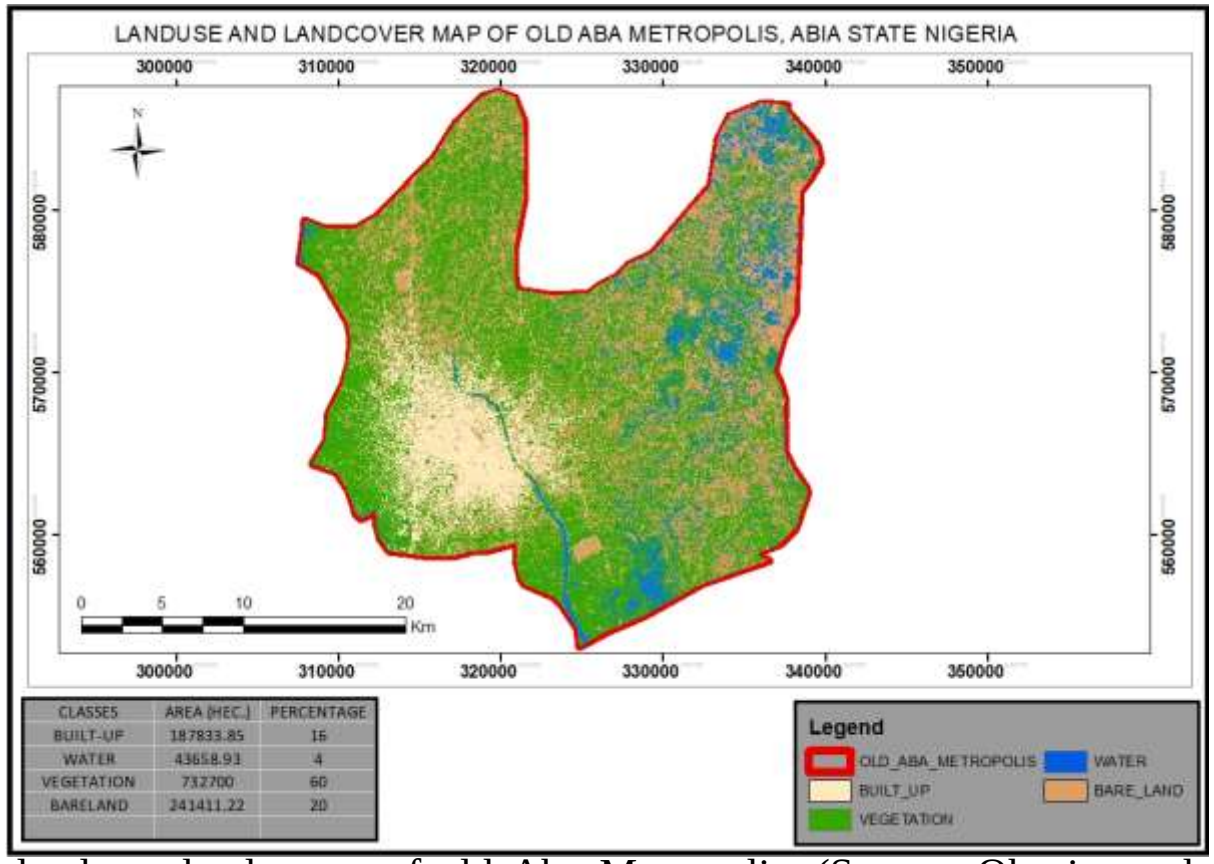


Hill shade map of old Aba Metropolis. (Source. Okezie et al. 2023)



Stream network map of the study area. (Source. Okezie etal. 2023)

RESULTS AND ANALYSIS (I)



land use land cover of old Aba Metropolis. (Source. Okezie et al. 2023)

Land use /Land cover classes	Areas (Hectares)	Percentage
Built-up areas	187833.850	16
Water bodies	43658.931	4
Vegetation	732700.080	60
Bare land	241411.220	20

Table 1 shows land use land cover analysis of old Aba Metropolis

DISCUSSION OF RESULTS

- The results obtained showed that the configuration of the landscape and undulation nature of the study area from figure 1-to figure 9, using contour, aspect, digital terrain model, hill shade, slope, land use / land cover and 3D wireframe. These digital derivatives are vital for good understanding, policy making and management of the physical environmental of the area under investigation.
- The result reveals that there is a number of streams within old Aba metropolis and all of them are connected to Aba blue River (water side).
- Figure 1.7 revealed a total of four land use classes identified within the study area. These are Built up areas, vegetation areas, bare land and water bodies. Further analysis revealed that Built up areas covers 187.833 km2 (16%), vegetation areas cover 732.700 km2 (60%), bare land covers 241.411sqkms (20%), water bodies cover 43.658km2. (4%).

CONCLUSION

- Topographic modelling analysis and land use management algorithms are two important tools for promoting sustainable development and this is fundamental for good selfless and management of the physical milieu.
- Based on this, robust method that produces reliable result must be adopted to ensure that the right decision is made during planning.
- The use of earth observation system (EOS) technology, Remote Sensing (RS) and GIS platforms have become an integrated, well developed and dependable method in terrain analysis. The result of this study revealed the various and multi-dimensional proficiencies of integrating remote sensing data and GIS in terrain modelling and analysis.

RECOMMENDATION

- This work is recommended for those in the bult industry, planners, developers, policy makers and academia. It is also served as a contribution to the body of work in terrain modelling analysis and required further investigations in other to achieved substantiable development within Sub-Sharan Africa.
- As a novel exercise, the gains of scientific study like this, cannot be over-emphasised, owing to the importance of land use/ Land cover study in the overall land inventory and planning for sustainability.
- It is necessary to recommend the incorporation of terrain analysis models of slope, aspect, DTM/DEM etc, for proper revelation of the character of the terrain or configuration of the topography, which could hamper good planning and development.

Thanks for listening